National Energy Board

Office national de l'énergie

Short-term Canadian Natural Gas Deliverability

2011-2013

AN ENERGY MARKET ASSESSMENT MAY 2011

Canada

National Energy Board | Office national de l'énergie

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Cat. No. NE2-1/2011E-PDF
ISSN 1910-7773

N° de cat. NE2-1/2011F-PDF
ISSN 1910779X

This report is published separately in both official languages. This publication is available upon request in multiple formats.

Ce rapport est publié séparément dans les deux langues officielles. On peut obtenir cette publication sur supports multiples, sur demande.

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CBM	coalbed methane
EMA	Energy Market Assessment
HH	Henry Hub (North American Gas Reference Price)
LNG	liquefied natural gas
NEB	National Energy Board
NGLs	natural gas liquids
PSAC	Petroleum Services Association of Canada
WCSB	Western Canada Sedimentary Basin

Units

m^3	= cubic metres
MMcf	= million cubic feet
Bcf	= billion cubic feet
m^3/d	= cubic metres per day
$10^6 m^3/d$	= million cubic metres per day
MMcf/d	= million cubic feet per day
Bcf/d	= billion cubic feet per day
GJ	= gigajoule
MMBtu	= million British Thermal Units

Common Natural Gas Conversion Factors

1 million m^3 (@ 101.325 kPaa and 15° C) = 35.3 MMcf (@ 14.73 psia and 60° F)
1 GJ (Gigajoule) = .95 Mcf (thousand cubic feet) = .95 MMBtu = .95 decatherms

Price Notation

North American natural gas prices are quoted at Henry Hub and given in $US/MMBtu.
Canadian natural gas prices are quoted as the Alberta Gas Reference Price and are listed in $C/GJ.

FOREWORD

The National Energy Board (the NEB or the Board) is an independent federal regulator whose purpose is to promote safety and security, environmental protection and efficient infrastructure and markets in the Canadian public interest[1] within the mandate set by Parliament for the regulation of pipelines, energy development, and trade.

The Board's main responsibilities include regulating the construction and operation of interprovincial and international oil and gas pipelines, international power lines, and designated interprovincial power lines. Furthermore, the Board regulates the tolls and tariffs for the pipelines under its jurisdiction. With respect to the specific energy commodities, the Board regulates the export of natural gas, oil, natural gas liquids (NGLs) and electricity, and the import of natural gas. Additionally, the Board regulates oil and gas exploration and development on frontier lands and offshore areas not covered by provincial or federal management agreements.

The Board also monitors energy markets, and provides its view of the reasonable foreseeable requirements for energy use in Canada having regard to trends in the discovery of oil and gas.[2] The Board periodically publishes assessments of Canadian supply and demand of energy and natural gas markets in support of its ongoing market monitoring. These assessments address various aspects of energy markets in Canada. This Energy Market Assessment (EMA) Short-term Canadian Natural Gas Deliverability, 2011–2013, is one such assessment. It examines the factors that affect natural gas supply in Canada in the short term and presents an outlook for deliverability through 2013.

While preparing this report, in addition to conducting its own quantitative analysis, the NEB held a series of informal meetings and discussions with drilling companies, natural gas producers, pipeline companies, and industry associations. The NEB appreciates the information and comments provided and would like to thank all participants for their time and expertise.

If a party wishes to rely on material from this report in any regulatory proceeding before the NEB, it may submit the material, just as it may submit any public document. Under these circumstances, the submitting party in effect adopts the material and that party could be required to answer questions pertaining to the material.

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1 The public interest is inclusive of all Canadians and refers to a balance of economic, environmental, and social considerations that change as society's values and preferences evolve over time.

2 This activity is undertaken pursuant to the Board's responsibilities under Part VI of the *National Energy Board Act* and the Board's decision in GHR-1-87.

If a party wishes to rely on material from this report in any regulatory proceeding before the NEB, it may submit the material, just as it may submit any public document. Under these circumstances, the submitting party in effect adopts the material and that party could be required to answer questions pertaining to the material.

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Overview

This report provides an outlook for Canadian natural gas deliverability (the ability to produce gas from new and existing wells) to the end of 2013.

Key factors influencing deliverability over this period are:

- an oversupply of North American natural gas due to continuing increases in U.S. shale gas supplies and reduced natural gas demand growth since the 2009 recession, and
- a shift in drilling activity in North America away from natural gas and toward crude oil and other liquid hydrocarbons (propane, butanes, and pentanes plus) to capitalize on higher oil prices.

These key factors have diverted investment and drilling activity away from natural gas in Canada and, notwithstanding significant reserves, could cause Canadian natural gas deliverability to decline over the projection period. Despite the potential decline, projected Canadian natural gas deliverability is anticipated to be more than sufficient to serve Canadian markets.

The decline in Canadian natural gas deliverability could slow or reverse if the North American natural gas market begins to experience a closer balance between demand and available supply that causes natural gas prices to move upward.

In the Mid-Range Case natural gas deliverability is expected to decrease from 380 $10^6 m^3/d$ (13.4 Bcf/d) in 2011 to 374 $10^6 m^3/d$ (13.2 Bcf/d) in 2012 to 364 $10^6 m^3/d$ (12.8 Bcf/d) in 2013.

KEY DRIVERS AND OUTCOMES

Major factors influencing Canadian natural gas deliverability include:

- Growing shale gas production in the U.S. is exceeding the growth in natural gas demand in North America.
- Increasing shale gas production allows the U.S. to meet more of its internal demand and provides less opportunity for the export of Canadian natural gas to the U.S.
    - Two new U.S. pipelines are going into service in 2011, taking U.S. production into traditional export markets for Canadian natural gas in the Midwest and along the West Coast.[1]
- Natural gas-fired power generation is competing with some of the older and less-efficient coal-fired units in some power generation markets. This competition occurs when North American natural gas prices decline to levels that are less than coal in those markets.
- The combination of price declines and reduced exports to the U.S. is reducing the attractiveness of producing Canadian natural gas.
- Canadian natural gas producers are responding by shifting drilling activity from natural gas to crude oil prospects.
    - In previous years, natural gas accounted for close to 80 per cent of the wells drilled in Canada, but may only represent about 40 per cent of the wells drilled in 2010 and 2011.
    - Horizontal drilling and multi-stage hydraulic fracturing techniques employed in shale gas developments are migrating into applications of crude oil recovery from formations previously considered too impermeable to produce commercial quantities of oil.
    - Increases in crude oil drilling will contribute to labour constraints and cost inflation in the drilling and service industries. This general cost inflation will spill over into Canadian natural gas activity to add to the competitive challenge posed by the decline in natural gas prices.
- Canadian producers are drilling a greater percentage of higher productivity wells in deeper formations in British Columbia and western parts of Alberta.
    - Regulatory changes in the Province of Alberta now allow production from multiple formations simultaneously thereby increasing the productivity of new wells in those areas.

1 The Bison Pipeline entered service in January 2011 with an initial capacity of 14.1 $10^3m^3/d$ (0.4 Bcf/d) to move natural gas from Wyoming into the Northern Border Pipeline that serves the U.S. Midwest. The Ruby Pipeline is scheduled to enter service in June 2011 with a capacity of 52.9 $10^3m^3/d$ (1.8 Bcf/d) to move natural gas from Wyoming into the Pacific Northwest and California.

    - The use of newer high-horsepower drilling rigs is increasing the efficiency of deeper drilling operations.
    - There is likely to be less natural gas activity in the shallower deposits in southeastern Alberta, Saskatchewan, and in New Brunswick due to low productivity from new wells.
- Levels of natural gas drilling in Canada over the 2011 to 2013 period may not be sufficient to offset the ongoing declines in output from existing producing wells. Under these conditions, there would be a gradual decrease in overall natural gas deliverability over the 2011 to 2013 period.
- The pullback in gas drilling is beginning to influence B.C.'s Horn River Basin shale gas, where activity was previously increasing.
    - Producers that are restraining their Horn River Basin drilling operations in 2011 are not relinquishing their positions in the area. Instead, they appear to be slowing their drilling plans until some point in the future when they judge that market conditions will be better.
    - Other Horn River Basin producers may maintain or increase activities over the 2011 to 2013 period, if agreements with joint venture partners help to cover a portion of the drilling costs.
- Producers will continue to target natural gas deposits that are richer in liquid hydrocarbons (propane, butanes, and pentanes plus) since those liquids provide an additional source of revenue.
- The development schedule for the Deep Panuke offshore project in Nova Scotia calls for the project to begin producing natural gas in the second half of 2011. The Deep Panuke volumes are likely to offset ongoing declines in output from the Sable Island fields.
- Shale gas operations in Quebec are currently the subject of public consultations and regulatory reviews. As a result no natural gas deliverability from the province is included in the outlook.
- Liquefied natural gas (LNG) imports into Canada and U.S. have stabilized at roughly 45.9 $10^3 m^3/d$ (1.3 Bcf/d) through much of 2010 and into 2011. This level represents only about eight per cent of Canada and U.S. import capacity. LNG imports are unlikely to increase as long as oversupply conditions in Canada and U.S. keep prices below European and Asia-Pacific regional markets.
- A moderating factor on any potential increase in North American natural gas prices is the potential for additional U.S. natural gas supplies to enter the market relatively quickly. These additional supplies include an inventory of drilled wells that are not yet completed or connected into the pipeline system. Much of this backlog of wells already drilled but not completed is due to high demand on the pressure-pumping operations used in the hydraulic fracturing process. This results in drilled wells that are not immediately producing gas due to lack of completion and tie-in.

ANALYSIS

As natural gas drilling activity slows and North American demand increases, natural gas prices may begin to trend upward, increasing the incentive for natural gas drilling. The timing and degree of this transition from declining to increasing natural gas activity is uncertain. To help address the uncertainty, the *Short-term Canadian Natural Gas Deliverability 2011 – 2013 EMA* examines three potential cases for Canadian natural gas deliverability. These cases differ primarily in terms of North American natural gas prices and the corresponding levels of capital investment. The cases also vary in terms of drilling levels in the Montney and Horn River prospects in Northeast B.C. Appendix A contains a detailed description of the methodology used in projecting deliverability. The three cases are a:

- Mid-Range Case that sees prices decline in 2011 and then trend upwards in 2012 and 2013
- High Case that sees prices rising above 2010 levels in 2011 through 2013
- Low Case where prices remain below 2010 levels through 2013

A summary of the key assumptions used in the cases and the deliverability results is in Table 3.1.

Western Canada is the main source of marketable gas production and currently accounts for approximately 98 per cent of total Canadian production. The Maritime Provinces provide most of the remaining gas production with smaller amounts from central Canada and the Northwest Territories.[4]

For this analysis, the Board divides natural gas production in western Canada into conventional, coalbed methane (CBM), and shale gas categories. Within the conventional gas category, the analysis provides a sub-category of tight gas. Due to large regional differences in physical and producing characteristics, the Board further subdivides these categories into smaller areas with similar characteristics for production decline analysis. Within each region, the producing formations are grouped on a geological basis. Details on the characterization of the resources are available in Appendix B.

Although affected by market prices, producers may not immediately alter their drilling activity. Participants in natural gas markets may "hedge" the prices they pay or receive by committing to an agreed-to price (or price range) for future transactions. This practice allowed some natural gas producers to obtain a higher average price in 2010 than the price paid for prompt transactions over the course of the year. Depending on the underlying price trends, the availability of a price premium or discount may result from the hedging activity. Indications are that less gas is hedged in 2011 than in 2010, and is likely to provide producers with less of a premium to market prices. The projection reflects some of the effects of hedging over the 2011 to 2013 period by assuming the drilling of additional wells above what might occur at the projected market prices.

4 The Canaport terminal in New Brunswick is the only operating LNG import terminal in Canada. Since gas supply for LNG projects comes from outside the country, LNG imports are not included in this report on Canadian gas deliverability.

TABLE 3.1

Overview of Assumptions and Deliverability Results

	2010	Mid-Range Case			High Case			Low Case		
		2011	2012	2013	2011	2012	2013	2011	2012	2013
Henry Hub (HH) Average Spot Price (US$/MMBtu)	$4.38[1]	$4.25	$4.50	$5.00	$5.25	$5.50	$6.00	$3.50	$3.75	$4.00
Alberta Gas Reference Price (C$/GJ)	$3.57[2]	$3.70	$3.92	$4.35	$4.72	$4.94	$5.37	$3.01	$3.23	$3.41
Natural Gas Drilling Expense ($ Millions)		7901	7949	7827	10274	10418	11256	5642	5567	5427
Natural Gas Intent Drill Days		48116	46103	43237	60273	55561	54081	34358	32600	30853
Natural Gas Intent Wells	4,309[3]	4033	3667	3375	5105	4394	4201	2632	2250	1876
Gas Share of Drill Days (per cent)	40	40	40	40	41	42	43	39	39	38
Size of WCSB Rig Fleet	799[4]	804	795	788	810	802	794	786	773	759
Canadian Deliverability ($10^6 m^3/d$)	**403[5]**	**380**	**374**	**364**	**387**	**392**	**389**	**371**	**351**	**331**
Canadian Deliverability (Bcf/d)	**14.2**	**13.4**	**13.2**	**12.8**	**13.7**	**13.8**	**13.7**	**13.1**	**12.4**	**11.7**

1. EIA - Short Term Energy Outlook, 08 Feb 2011, http://www.eia.doe.gov/emeu/steo/pub/contents.html
2. Government of Alberta, Alberta Gas Reference Price History - January - December 2010, http://www.energy.alberta.ca/NaturalGas/1322.asp
3. PSAC Estimate - 31 January 2011
4. CAODC Estimate - 22 October 2010
5. Annual average of reported provincial production. Estimate based on pipeline field receipts used where provincial data unavailable.

DELIVERABILITY OUTLOOKS

The three cases cover the range from a Low Case where an ongoing oversupply of natural gas in North America reduces the economic incentive to produce Canadian natural gas, to a High Case where natural gas supply and demand move into balance quickly and provide a strong push toward steady levels of natural gas activity in Canada. A Mid-Range Case follows a moderate course with a gradual transition towards a more balanced market by 2013. A comparison of the three Canadian natural gas deliverability outlooks to 2013 under these alternative market conditions is in Figure 4.1.

The levels of drilling activity that provide these deliverability outcomes are the result of capital investment assumptions and estimates of drilling costs. A comparison of natural gas drilling activity in the three cases in terms of drill days and gas-intent wells drilled are in Figure 4.2 and Figure 4.3, respectively.

Mid-Range Case

In this case, oversupply conditions drive North American natural gas prices lower in 2011. In response, producers reduce natural gas drilling in the U.S. and Canada. With lower drilling, U.S. production growth ceases by the end of 2011 and demand growth in 2011 results in more balanced market conditions by 2012. As markets become more balanced, natural gas prices begin to rise gradually. However, the modest increase in prices is not sufficient to encourage an increase in natural gas drilling in Canada in 2012 and 2013.

FIGURE 4.1

Deliverability Results

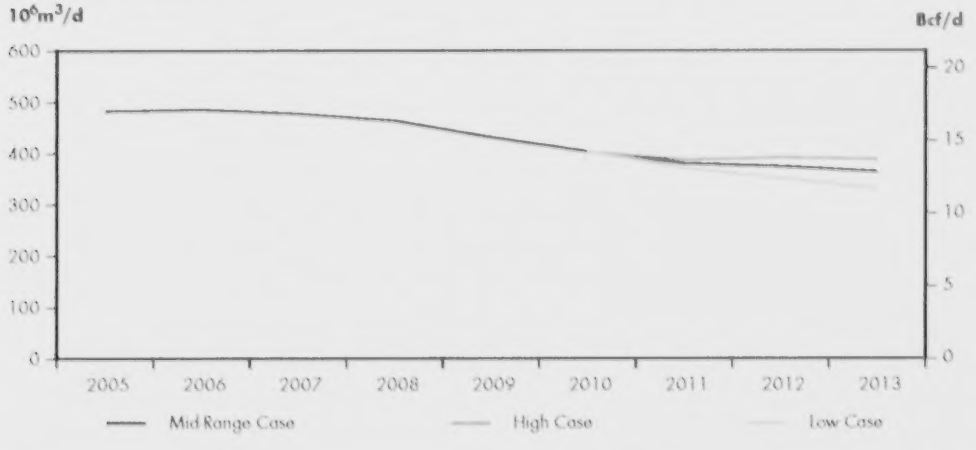


FIGURE 4.2

Gas Intent Drill Days Comparison

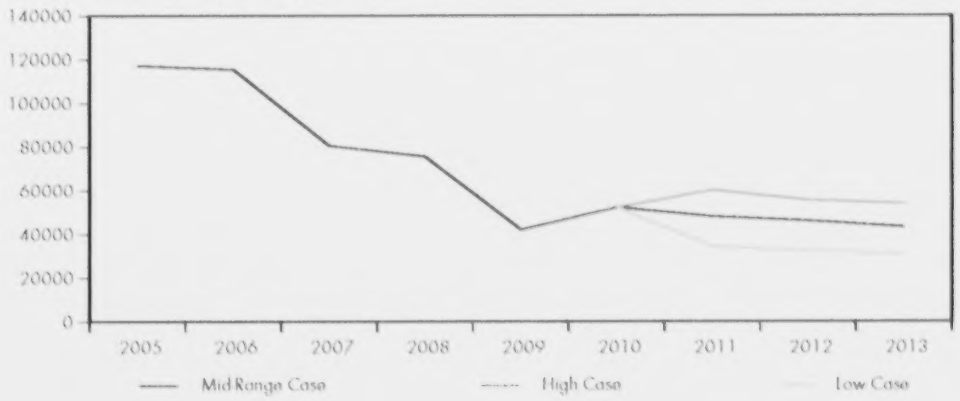
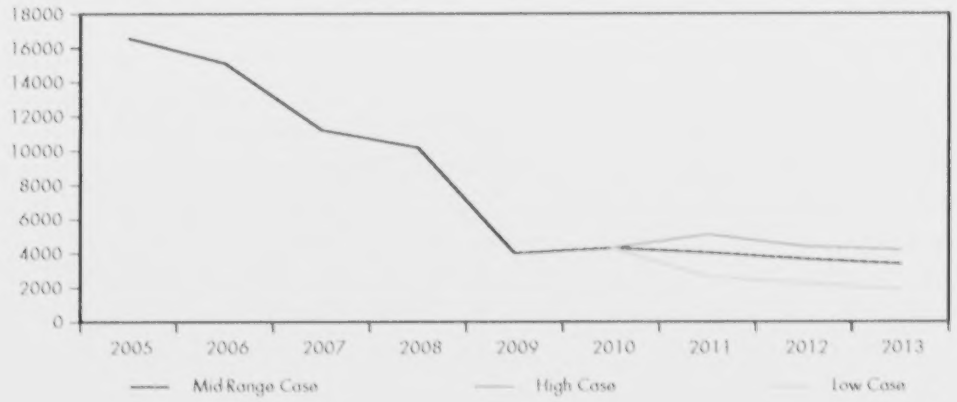


FIGURE 4.3

Gas Intent Wells Drilled Comparison



Deliverability Results

In this Mid-Range Case, Canadian natural gas deliverability trends downward but continues to be more than adequate to meet Canadian requirements. As drilling decreases in 2012 and 2013, the rate of decline in deliverability slows slightly due to higher productivity wells coming on-stream. Tight gas and shale gas activity rises in 2012 with 268 wells drilled in the Montney and 82 in Horn River and continues to increase in 2013. Horn River deliverability increases from 6.9 $10^6 m^3/d$ (243 MMcf/d) in 2010 to 16.1 $10^6 m^3/d$ (570 MMcf/d) in 2013. British Columbia Montney deliverability increases from 13.5 $10^6 m^3/d$ (476 MMcf/d) in 2010 to 53.35 $10^6 m^3/d$ (1883 MMcf/d) in 2013.

Implications

This case depends on a slowing of U.S. shale gas drilling activity to enable natural gas demand to catch up to supply and provide more balanced market conditions. The slowing of U.S. shale gas drilling might reflect completion of the drilling required to hold leases purchased through the 2008 period. With these leases retained by means of a single producing well on each section, producers could start diverting additional drilling activity toward oil targets. Growth in Canadian natural

gas demand would consume a larger proportion of the country's available deliverability, thereby reducing the volume available as net exports.

Full results of this case are available in Appendix C.

TABLE 4.1

Mid-Range Case Summary and Results

	Average HH Price $US/MMBtu	Gas Intent Drill Days	Gas Intent Wells	Average Deliverability	
				$10^6m^3/d$	Bcf/d
2010E	$4.38[1]		4309[2]	403[3]	14.2
2011	$4.25	48116	4033	380	13.4
2012	$4.50	46103	3667	374	13.2
2013	$5.00	43237	3375	364	12.8

1. EIA – Short Term Energy Outlook, 08 Feb 2011. http://www.eia.doe.gov/emeu/steo/pub/contents.html
2. PSAC Estimate – 31 January 2011.
3. Annual average of reported provincial production. Estimate based on pipeline field receipts used where provincial data unavailable.

High Case

In this case, U.S. shale gas supply might decline more rapidly despite prices rising above 2010 levels in 2011 through 2013. This situation might result from a lack of workers and equipment available to U.S. hydraulic fracturing operations or a greater transfer of well drilling and completion services to oil targets than in the Mid-Range Case. In response to rising North American natural gas prices, there would be more natural gas-intent drill days in Canada than in the Mid-Range Case. The additional drill days significantly boost the number of gas-intent wells in 2011. The number of new gas-intent wells gradually declines in 2012 and 2013 as the average well becomes deeper and takes more days to drill. In addition, the possibility exists that low cost coal will slow the transition to increased utilization of natural gas-fired power generation.

Deliverability Results

Canadian natural gas deliverability declines more slowly than in the Mid-Range Case due to the additional gas-intent drilling. Deliverability decreases from 403.2 $10^6m^3/d$ (14.2 Bcf/d) in 2010 to 389 $10^6m^3/d$ (13.7 Bcf/d) by 2013. Tight gas and shale gas are the primary sources of production growth between areas, but shallower, less complex developments also begin to attract some additional capital. Horn River deliverability increases from 6.9 $10^6m^3/d$ (271 MMcf/d) in 2010 to 18.93 $10^6m^3/d$ (668 MMcf/d) in 2013. British Columbia Montney deliverability increases from 13.5 $10^6m^3/d$ (476 MMcf/d) in 2010 to 60.1 $10^6m^3/d$ (2123 MMcf/d) in 2013.

Implications

In the High Case, growth in oil activity might need to slow to enable increases in natural gas drilling without sparking significant labour shortages and cost escalation.

Full results of this case are available in Appendix C.

TABLE 4.2

High Case Summary and Results

	Average HH Price $US/MMBtu	Gas Intent Drill Days	Gas Intent Wells	Average Deliverability	
				$10^6m^3/d$	Bcf/d
2010E	$4.38[1]		4309[2]	403[3]	14.2
2011	$5.25	60273	5105	387	13.7
2012	$5.50	55561	4394	392	13.8
2013	$6.00	54081	4201	389	13.7

1. EIA – Short Term Energy Outlook, 08 Feb 2011. http://www.eia.doe.gov/emeu/steo/pub/contents.html
2. PSAC Estimate – 31 January 2011.
3. Annual average of reported provincial production. Estimate based on pipeline field receipts used where provincial data unavailable.

Low Case

The Low Case relies on a continuation of high levels of U.S. shale gas drilling despite prices remaining below 2010 levels through 2013. This situation might occur if U.S. shale gas drilling were to achieve significantly lower unit costs through efficiency improvements. These efficiency improvements might be associated with drilling at closer spacing and by drilling multiple wells from the same location. Declines in U.S. conventional, tight gas, and CBM deliverability would need to be more than offset by increases in U.S. shale gas output for this to occur. This case might also rely on mild weather conditions to depress natural gas demand and cause large volumes of natural gas to remain in storage from year to year.

Deliverability Results

Canadian natural gas deliverability declines steadily to 331 $10^6m^3/d$ (11.7 Bcf/d) in 2013, a decrease of 72 $10^6m^3/d$ (2.5 Bcf/d) from 2010. Natural gas prices would limit the ability to attract additional investment to the sector, particularly if oil-related activity was increasing significantly at the same time.

Implications

In the Low Case, Canadian natural gas consumers would benefit from lower natural gas prices. However, this case also results in a rapid decline in natural gas deliverability. This is in part due to increases in oil-related activity that might be able to compensate for reduced natural gas operations to sustain the Canadian drilling and service industry. The potential transition toward oil and away from natural gas would tend to shift investment away from B.C. and into Saskatchewan. The outcome would be less clear in Alberta as oil activity would rise while natural gas activity declines.

TABLE 4.3

Low Case Summary and Results

	Average HH Price $US/MMBtu	Gas Intent Drill Days	Gas Intent Wells	Average Deliverability	
				$10^6m^3/d$	Bcf/d
2001OE	$4.38[1]		4309[2]	403[3]	14.2
2011	$3.50	34358	2632	371	13.1
2012	$3.75	32600	2250	351	12.4
2013	$4.00	30853	1876	331	11.7

1. EIA – Short Term Energy Outlook, 08 Feb 2011. http://www.eia.doe.gov/emeu/steo/pub/contents.html
2. PSAC Estimate – 31 January 2011.
3. Annual average of reported provincial production. Estimate based on pipeline field receipts used where provincial data unavailable.

Full results of this case are available in Appendix C.

The Board's outlooks for gas deliverability and Canadian gas demand over the projection period are included in Table 4.4 to provide market context for the relative changes in gas deliverability. The Board projects annual Canadian natural gas demand to grow by 17 $10^6m^3/d$ (0.6 Bcf/d) between 2010 and 2013. Most of this increase would be from increased usage for oil sands development in western Canada. The outlook for Canadian natural gas deliverability fails to keep pace with projected demand growth in all cases.

TABLE 4.4

Average Annual Canadian Deliverability and Demand

	2010		2011		2012		2013	
	$10^6m^3/d$	Bcf/d	$10^6m^3/d$	Bcf/d	$10^6m^3/d$	Bcf/d	$10^6m^3/d$	Bcf/d
Canadian Deliverability, Mid Range Case	403	14.2	380	13.4	374	13.2	364	12.8
Western Canada Demand	167	5.9	169	6.0	171	6.1	173	6.1
Eastern Canada Demand	99	3.5	104	3.7	107	3.8	110	3.9

Key Differences from Previous Projections

The Board has conducted a similar deliverability analysis since 2004. Comparing the actual performance in deliverability with the Board's most recent assessment, Short-term Canadian Natural Gas Deliverability 2010–2012, Canadian natural gas prices tracked closer to the Board's Low Price Case, however deliverability was higher than forecast and was closer to the Board's High Price Case from the 2010 report.[5] This occurred because Canadian producers were able to hedge a significant portion of their deliverability at prices in excess of $6.00/GJ. In effect, while Alberta spot market prices may have been below $4.00/GJ in 2010, producer hedges might have provided revenues closer to the $6.50/GJ level.

A second key difference is higher productivity from wells drilled in 2009 and 2010 than was anticipated in the Board's 2010 report. At the reduced natural gas drilling activity levels experienced in 2009 and 2010, service companies improved the output from the wells drilled in those years. This likely reflects technology advances such as longer lateral lengths of wells with increased fracture stages. It also likely reflects the ability of producers to focus on and produce from only the best prospects.

5 National Energy Board, *Short-term Canadian Natural Gas Deliverability 2010–2012*, Available at www.neb-one.gc.ca.

OBSERVATIONS

- Canadian natural gas prices generally increased from 2003 to 2008, averaging almost $7.00/GJ. Since that time, prices have averaged closer to $4.00/GJ.
- Canadian natural gas production rode the upward price trend to peak at roughly 617.8 $10^6 m^3/d$ (17.5 Bcf/d) in 2006 and has since declined with prices to about 403.2 $10^6 m^3/d$ (14.2 Bcf/d) in 2010.
- Despite the decline, projected Canadian natural gas deliverability is more than sufficient to serve Canadian markets.
- After three years of declines, Canadian natural gas production stabilized in 2010 despite only a modest increase in drilling activity. The key reason is a transition to higher productivity wells in shales and deeper horizons in B.C. and in western Alberta.
- The rise in oil-related activity and corresponding increase in drilling rates is likely to result in an active Canadian drilling and service industry despite the downturn in natural gas activity. These higher drilling and service rates will also apply to the natural gas industry and add a challenge to any short-term increases in natural gas drilling.
- Increases in North American natural gas demand would partially offset the rise in U.S. shale gas production and accelerate a return to more balanced market conditions. The level of natural gas demand is dependent on a number of unpredictable factors, such as the pace of global economic recovery and North American weather conditions.
- U.S. horizontal drilling for shale gas has increased since 2008 despite the significant decline in prices since that time. This is partly due to the desire to retain costly leases by drilling and producing gas from a single well per section. This may change as more leases are retained over 2011, potentially causing U.S. shale gas drilling to become more responsive to market prices.
- Producers are increasingly targeting natural gas deposits that contain higher levels of liquid hydrocarbons (propane, butanes, and pentanes plus). With these liquid hydrocarbons generating an increasing share of the revenue, the drilling of these natural gas wells may become less responsive to natural gas prices and more responsive to oil prices.
- Natural gas revenues available for reinvestment may be lower in 2011 due to the expiry of price hedges arranged when prices were higher.

Appendix A

A1 Methodology (Detailed Description)
A2 Deliverability Parameters - Results
A3 Decline Parameters for Groupings of Existing Gas Connections
A4 Decline Parameters for Groupings of Future Gas Connections

Appendix B

B1 Factors for Allocation of Gas-Intent Drill Days to Resource Groupings
B2 Detailed Gas-Intent Drilling and Gas Connection projections by Case

Appendix C

Deliverability Details by Case

Appendix D

Total Canadian Deliverability Comparison of Cases

Appendix E

Average Annual Canadian Deliverability and Demand

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